Scottish Health Technical Memorandum 2024

(Part 1 of 4)

Operational management

Lifts

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1. Scope

General

1.1 Healthcare premises are dependent upon lifts to provide an efficient, fast and comfortable vertical transportation service for the movement of patients, staff, visitors, medical equipment and ancillary services items.

NOTE: Throughout this document, healthcare premises have also been referred to as hospitals.

1.2 All lifts are subject to strict statutory regulations which cover operational safety to ensure that passengers can be fully confident that the lift service is safe to use.

NOTE: Lifts in healthcare premises provide an essential service that may not always be fully appreciated by the users.

1.3 The scope of this Scottish Health Technical Memorandum does not cover manual lifts, hoists, escalators and paternosters. Paternosters are considered too hazardous in a healthcare environment.

User considerations

1.4 The psychological aspects of lift design in terms of being user-friendly need to be addressed to allay anxieties and fears of users.

1.5 Travelling in a lift can be perceived as dangerous by persons of a nervous disposition, in several different ways, but mainly from the notion of being isolated in a sealed box inside a vertical well which extends from the lowest ground floor level to the top floor of the building.

1.6 A common claustrophobic fear is that of being trapped between floors without the means to communicate with persons outside to give warning of the predicament or to receive reassurance that assistance is at hand.

1.7 Physiological constraints affect the rates of acceleration and deceleration which the human body can comfortably withstand and in healthcare premises, the selection of operational lift speed is important to minimise any adverse effects on patients.

1.8 Psychological appreciations are more subtle and can be influenced by the lift finishes, decor, apparent reliability, frequency and transit time of the service.

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2. Management responsibilities

2.1 It is incumbent on management to ensure that their lift installations comply with all the statutory regulations applicable to lifts on their premises. Other functional guidance in terms of standards and codes of practice should also be noted.

Statutory requirements

2.2 Safety regulations are as laid down in the:

a. Offices, Shops and Railway Premises (Hoists and Lifts) Regulations 1968;
b. Health and Safety at Work etc Act 1974;
c. Electricity at Work Regulations 1989;
d. Fire Precautions Act 1971, (as amended by the Fire Safety and Safety of Places of Sport Act 1987);
e. Factories Act 1961 (as amended);
f. The Building Standards (Scotland) Regulations 1990 (as amended);
g. Lifting Operations and Lifting Equipment Regulations 1998;
h. Management of Health and Safety at Work Regulations 1999;
i. Workplace (Health, Safety and Welfare) Regulations 1992;
j. Construction (Design and Management) Regulations 1994;
k. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR);
l. Electromagnetic Compatibility Regulations 1992, (as amended);
m. Supply of Machinery (Safety) Regulations 1992.

Functional guidance

2.3 Guidance is as laid down in:

a. British Standards and Codes of Practice;
b. Health and Safety Executive Guidance;
c. NHS Model Engineering Specifications;
d. Health Building Notes;
e. Scottish Hospital Technical Notes;
f. Scottish Technical Memoranda NHS in Scotland Firecode - NHS Estates;

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g. Scottish Hospital Planning Notes;

h. The Technical Standards for compliance with the Building Standard (Scotland) Regulation 1998.

For further details please refer to the references section.

2.4 The Offices, Shops and Railway Premises (Hoists and Lifts) Regulations 1968 require that a lift will function without injury or danger to the general public and passengers.

Safety applications

2.5 The Factories Act 1961 and the Offices, Shops and Railway Premises (Hoists and Lifts) Regulations 1968 require that every power-driven lift should be of good mechanical construction, sound material, adequate strength, properly maintained and thoroughly examined by a competent person (lifts) at least once in a period of six months and that a report of the result of every such examination should be prepared on the prescribed form F2530, (previously F54) (see paragraph 4.4), signed and dated by the person carrying out the examination.

NOTE: Competent person (lifts) – refer to Chapter 12, 'Designated staff functions'.

2.6 The report should be retained and kept readily available for inspection for at least two years after the date of the lift examination.

2.7 The legal responsibility for ensuring that lifts are properly maintained rests with the management of the healthcare premises in which the lifts are installed.

2.8 At present, while there is no legal requirement for new lifts to be tested before being taken into service, it is strongly recommended that all lifts should be examined and tested in accordance with BS 5655 Part 1: 1986, by a competent person (lifts). (Reference should also be made to BS EN 81-1: 1998).

2.9 Fire regulations require that certain lift controls can be operated by the fire brigade so that firemen can take immediate control of the lift for safety and fire-fighting purposes.

2.10 At least one bed-lift in an acute hospital should be connected to the emergency electrical supply system in line with the guidance contained in SHTM 2011; *Emergency electrical services*.

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2.11 All passenger and bed/passenger lifts should be fitted with an emergency intercommunication point.

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3. Functional overview

Types of lift

3.1 There are two main types of lift installed in healthcare premises; these are:

a. traction lifts,

b. hydraulic lifts.

Consideration should be given to the running (maintenance) costs incurred over the life span of the lift installation when comparisons are made between traction and hydraulic lifts.

Traction lifts

3.2 Traction lifts are most commonly used in high rise buildings. They are rope-driven where the drive is by an electric variable speed motor, through a gearbox. This type has a lift car which travels vertically up and down a lift well between the lowest ground floor and the top floor. The lift car's weight is counter balanced throughout its full travel in the lift well.

3.3 Magnetic brake systems control the lift car movements between landing levels, in the event of an overtravel the bottom of the lift well is cushioned by a buffer recoil mechanism. The top is protected for the safety of maintenance personnel, by first and second overtravel limit switches to give adequate top of car clearance.

3.4 The traction lift is versatile and can be designed to operate at very fast speeds, such as is required in high-rise buildings. Passenger lifts can routinely carry up to 21 passengers (1.6 tonnes) at speeds of 0.5 to 3.5 metres per second (100 to 700 ft/min), depending on travel and duty.

Hydraulic lifts

3.5 Hydraulic lifts are suitable for applications in low-rise buildings usually up to a maximum of four floors. They utilise less plantroom space and, in general, the overall capital cost is lower than the traction lift.

3.6 The hydraulic lift is powered by oil-operated ram(s). For the direct acting type, the rams are located below or to the side of the lift car and for the indirect action type it is usual to have a driving mechanism with a side jack arrangement. The extended vertical length of the ram is physically limited and this in turn limits its suitability for low-rise buildings.

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3.7 Hydraulic lifts generally operate at a slower speed in the raise direction than for lowering. Lowering is by gravity, and is speed controlled by restrictors in the hydraulic oil return path from the ram(s) to the hydraulic pump reservoir tank.

Categories of lift

3.8 Lifts are categorised according to their use. In healthcare premises they fall into one of the following categories:

a. **passenger lifts**: intended to carry standing and wheelchair-seated passengers. Typical carrying capacity varies from 600 to 1000 kg;

b. **bed/passenger lifts**: generally constructed to similar standards as passenger lifts but have a car of larger dimensions. This permits the carrying of a passenger (patient) on a bed or trolley together with the necessary staff and equipment. Typical carrying capacity varies from 1600 to 2500 kg;

c. **goods lifts**: typically carry up to 5 tonnes. Goods lifts that are also used to carry passengers should conform in all respects to the regulations governing the use of passenger lifts;

d. **service lifts**: service lifts are not designed to carry passengers. They are arranged to be called and despatched externally, normally by a call point adjacent to each level hatch or access door, and are generally used for small loads.

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4. Testing and inspection criteria

4.1 Lifts in healthcare premises are subject to a statutory regime of inspection. Management should ensure that their operational procedures include the nomination of individuals to keep lifts in the required safe condition and to arrange for the mandatory inspections to be carried out at the prescribed intervals.

4.2 Every power-driven lift should be thoroughly examined at least once every six months (see paragraph 2.5). Lift examination should be supervised and performed only by an appointed competent person (lifts). It is therefore of the utmost importance that safety requirements are borne in mind at all times and that only approved and regulated procedures are applied.

4.3 Lifts are subject to the Electricity at Work Regulations 1989. Compliance is obtained by ensuring that only authorised personnel have access to electrical equipment and supplies. Electrical wiring and circuits in lift cars should be securely enclosed to prevent unauthorised access. Similarly, lift motor rooms and hydraulic machine rooms should be kept locked and the procedures of SHTM 2020; *Electrical safety code for low voltage systems* strictly applied.

4.4 Healthcare premises are subject to the requirements of the Health and Safety at Work etc Act 1974. The Health and Safety guidance note PM 7 recommends that the inspection standards contained in the Factories Act 1961 and the Offices, Shops and Railway Premises (Hoists and Lifts) Regulations 1968 be applied in other work places which includes healthcare premises. Health and Safety Executive HM Factory Inspectorate Form F2530 (previously F54) has to be completed for any lift installations to which these Acts apply.

4.5 Insurance companies will only provide cover for lifts if the legal inspection requirements have been met. It is customary for their inspectors to carry out the statutory examination of lifts which they insure. It should be noted that insurance inspection reports refer to the condition of the lift at the time of inspection. Local management is responsible for ensuring that a satisfactory standard is maintained.

4.6 The purpose of thorough examination and testing is to ascertain whether the lift installation may continue to remain safely in service.

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5. Electrical and mechanical safety at work

5.1 Electrical supplies to a lift installation will be only classified as low voltage (LV). The application of electrical safety is subject to the requirements of the Electricity at Work Regulations 1989.

NOTE: Refer to SHTM 2020.

5.2 Mechanical safety procedures are not detailed in any of the above stated documents, but recognition of the need for safe working practices is essential.

5.3 Only competent persons (lifts) should be allowed to work on, or in the vicinity of, any lift equipment or within the lift well.

5.4 When any work is required to be undertaken by non-competent persons in the vicinity of the lift equipment, for example in the lift well or machine room, the work must be carried out under the supervision of a competent person (lifts) who will be responsible for ensuring that the lift equipment is “safe”.

5.5 Additional safety precautions should be taken to prevent unsafe lift car movement when working in the lift pit, on the brake, on top of the lift car, or on the hydraulic oil mechanism.

5.6 When working on lift landings with the landing entrances open, the competent person (lifts) should ensure that the recommendations of PM 26 are complied with, which includes the provision of a landing entrance barrier.

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6. Lift examination

6.1 Guidance on lift examination was first offered by HM Factory Inspectorate (HMFI) in Technical Data Note (TDN) No. 51. This later became Health and Safety Executive Note PM 7. TDN 51 was drafted as a result of HMFI investigations into lift accidents and failures which indicated that certain important components of lifts were not receiving the attention they merited when a thorough examination was carried out.

6.2 Accordingly, this note draws attention to certain key lift components which, by nature of their construction and accessibility, may not be exposed for the periodic examination and also gives recommendations on the testing of the safety gear and an examination of the suspension system. The guidance is intended to remind persons responsible for making arrangements for thorough examinations and competent persons (lifts), who carry out these examinations, of the need to pay particular attention to such components.

NOTE: It is not intended to affect the activities of lift fitters, mechanics and electricians employed in the installation, maintenance and repair of lifts.

6.3 To ensure the continued safe use of a lift, PM7 recommends maximum intervals between the examination of certain key components. It should be borne in mind that the design and construction of most lifts may require that arrangements be made for some of these components to be dismantled to determine their condition.

6.4 The advice contained within this note should not be regarded as exhaustive of those matters which need to be covered by a thorough examination, nor is it intended to relieve persons undertaking examinations of their statutory responsibilities.

6.5 Where PM7 quotes the maximum intervals between thorough examinations (for example five years, ten years), these are intended as guidance for a lift in average use. Some hospital lifts may be subject to such intensive use that they incur the same number of trips in five years that a typical office lift achieves in ten years.

6.6 It is the responsibility of the management to ensure that the lift is inspected and tested at intervals suitable for the intensity of use.

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7. Maintenance

General

7.1 It is not sufficient to carry out maintenance only in response to a breakdown. To fulfill statutory requirements, lifts must be serviced regularly.

7.2 A planned preventative maintenance programme should be put in place to reflect the requirements of the particular site.

7.3 It is usual for lifts to be maintained by a specialist lift contractor rather than by the hospital estates engineering staff. Few hospital sites are large enough to require a dedicated in-house lift maintenance staff.

7.4 The complexity of modern lifts requires specialist training and support which is expensive to sustain in-house since, in order to provide adequate cover, more than one maintenance person will be required. It is often more economical to employ the services of a lift maintenance contractor.

Types of maintenance contract

7.5 Maintenance contracts will vary according to the type of building and lift usage; however, the two main types of contract are as follows:

a. **service contract** this generally provides for a fixed number of site visits to carry out general inspection, lubrication and minor adjustments only. All repairs are undertaken at an agreed rate for materials and labour. However, although organisations may prefer this type of contract because initially it is a cheaper option than a fully comprehensive contract, there can be disadvantages in the long term, for example:

   (i) there is often no budget provision for non-essential repairs. However, as the lift equipment ages, unattended non-essential repairs soon become essential. This inevitably leads to poor performance, accelerated deterioration of the equipment, an increased number of failures and, ultimately, increased costs;

   (ii) service contracts on old lifts should be managed carefully to ensure that any repair work recommended by contractors is properly investigated so that only genuine repairs are undertaken. Potential failures should be assessed and budgeted for;

NOTE: This type of contract is sometimes commonly referred to as an “oil and grease maintenance”.

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b. **fully comprehensive maintenance contract**: this type of contract guarantees regular maintenance of the lift installation. It usually includes all costs associated with replacement parts, labour, attending to call-outs and the required statutory tests, etc. Advantages include:

(i) the opportunity to obtain fully comprehensive maintenance of the lift(s) for a fixed annual premium, which may be index linked, thereby allowing for budgeted maintenance and a reasonably high performance to be achieved throughout the life of the lift;

NOTE: Short term contracts may allow the contractor to neglect proper maintenance during early years leaving defective equipment for successive contractors.

(ii) the benefits which may be derived from placing the contract with the maintenance contractor for a reasonably long period, ideally the life of the lift, say 15 years. This would encourage the lift contractor to commence with a high standard of maintenance that will not cause him trouble in later years;

(iii) increased product familiarity, therefore reduced training needs if the lift contractor is engaged for a long period. The ongoing maintenance costs of the lifts should be considered an operational cost of the building;

(iv) a balanced cost of maintenance over the life of the lift: whilst the maintenance premium of comprehensive maintenance may initially appear high for a new lift, the activity by the lift contractor will increase as the lift ages, thus justifying the expense.

7.6 The terms and wording of any comprehensive contract offered by a lift contractor require detailed examination before engagement and, where necessary, amending by agreement.

NOTE: Specialised maintenance contracts may be considered where a particular site requires a type of maintenance agreement that is neither “service” nor “comprehensive”. The cost implications should be considered.

7.7 Each lift maintenance contractor will have his own proforma maintenance proposals which will all invariably contain subtle differences and qualifications.

7.8 Whatever type of contract is employed, the management should consider the standard of maintenance undertaken to verify compliance with contract requirements.

NOTE: Reference should be made to the guidance contained in PROCODE.

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8. Routine maintenance

8.1 Routine maintenance can be divided into three main categories:

a. systematic examination, adjustment and small component replacement;

b. periodic lubrication;

c. reporting unsafe conditions and major repair requirements.

8.2 In practice this means that whilst the person responsible for maintenance should visit the unit at least once a month, a thorough inspection of the whole installation will not necessarily be carried out every time. A systematic approach is more practical, with the number and frequency of maintenance checks to be adjusted to suit the use and condition of the lift system.

8.3 Maintenance is not just a function of the appointed lift maintenance contractor but should also be undertaken, to some degree, by appointed hospital estate maintenance staff.

8.4 A member of the hospital maintenance staff should carry out regular checks in between the visits of the lift maintenance contractor. Typical examples of these checks include:

a. testing alarm bells;

b. checking intercoms or telephones;

c. ensuring all lights are illuminated;

d. checking emergency lighting systems;

e. testing the operation of car door safety devices.

8.5 Further dynamic checks are recommended such as:

a. checking smoothness of starting and stopping of the lift car;

b. listening for any squeaks or scraping sounds;

c. checking for any judder as doors operate;

d. ensuring that the lift levels are within the normal tolerances;

e. checking that indicators are showing the correct displays.

8.6 If any faulty item is identified which may affect safety, the staff member should take all necessary precautions and remove the lift from service.

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NOTE: Staff members should not attempt to make any repairs to a lift which is maintained under a fully comprehensive contract as this may invalidate any warranties that the contract offers. The lift maintenance contractor should be called out.

8.7 Staff members should also be trained in methods of “emergency hand-winding” of traction lifts and “emergency hand-lowering” of hydraulic lifts. They should also be trained in the release of trapped passengers.

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9. Emergency procedures

General

9.1 The emergency procedures for the safe hand-winding of electric traction lifts and hand-lowering of hydraulic lifts should be displayed prominently in the lift machine room and be contained within the lift service manual.

9.2 Several staff members should be trained in emergency hand-winding procedures and at least two or more such personnel should be available on the same shift to perform this function if the need should arise.

9.3 Staff should be trained and designated in such an emergency to release trapped passengers.

9.4 Where considered appropriate by management, designated staff training may be examined by staging an exercise to hand-wind a stranded lift to a floor and release the trapped passengers.

NOTE: All such exercises should be undertaken in the presence of a competent person (lifts) or/and with the participation of the lift maintenance contractor.

Breakdown hand-winding

9.5 If a loaded lift has stopped between floors, the safety of maintenance staff during the operation to release the passengers should be ensured. The following is a typical procedure:

a. establish communications:

b. reassure passengers and instruct them to remain still, calm and quiet;

c. isolate the incoming electrical supply;

d. first person: fit the emergency winding wheel, if not integral with the brake, and hold the wheel firmly;

e. second person: release the brake with the tool provided. Do not wedge off;

f. third person: posted on landing to ensure passengers do not attempt to get out of the car whilst hand-winding is in progress;

g. co-ordinate work together: brake off, when winding. Brake on, before grip on winding wheel is released/relaxed. Move the car down/up to the nearest landing;

h. make sure the brake is holding firmly on before opening the doors;

i. take winding wheel off shaft, if removable type;

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j. lift to remain out of service until fault has been corrected.

Release of instantaneous safety gear

9.6 Passengers should be reassured that the breakdown is being attended to. Allow passengers to leave if the car has reasonable access to a landing.

9.7 Establish the reason for operation of the safety gear.

9.8 Take the necessary action to correct the fault.

9.9 Reset the safety gear by hand-winding the lift up.

9.10 Allow the passengers to leave, if still on board.

9.11 Examine the guides and maintain if necessary.

9.12 Test the lift prior to putting it back into service.

Release of progressive safety gear

9.13 Passengers should be reassured that the breakdown is being attended to. Allow passengers to leave if the car has reasonable access to a landing.

9.14 Establish the reason for the operation of the safety gear.

9.15 Take the necessary corrective action.

9.17 Release the safety gear by winding back the operating rope onto the drum, thus releasing the clamps.

9.18 Hand-wind the lift to the next convenient floor to release passengers, if still on board.

9.19 Test the lift prior to putting it back into service.

Safety precautions

9.20 Care should be taken to avoid trapping hands when closing or opening a hand-operated gate.

9.21 The safety edge of a power-operated door should not be pushed in an effort to re-open it when it is closing.

9.22 No attempt should be made to enter a lift whilst the doors are closing.

9.23 It is essential that warning notices and guards are not ignored or removed when a lift is taken out of service.

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10. Maintenance information

The following is a guide to the type of maintenance work that is required to be undertaken as part of any maintenance contract. However, it should not be regarded as comprehensive data on which to draft a maintenance contract.

Inspection and servicing procedures

Precautions/procedures to be taken by contract maintenance staff

10.1 Report arrival to the responsible person as designated by the hospital management.

NOTE: The term “service person” denotes a contract maintenance staff member.

10.2 Before putting a lift out of service, warning notices should be placed at each landing entrance.

NOTE: On completion of the work all warning notices should be removed, the log card signed and the responsible person advised accordingly.

10.3 Isolate the electrical supply at the mains before attempting to clean or adjust any machinery or equipment.

NOTE: Refer to SHTM 2020.

10.4 Beware of "nip-points", such as those between ropes and sheaves, when inspecting rotating equipment.

10.5 Ensure that guards are correctly replaced on completion of work.

10.6 Exercise great care when working on, or near, live electrical equipment.

10.7 Ensure that the machine room doors are closed and locked when the room is not occupied.

10.8 Keep the machine room and pit clear of rags, waste or discarded materials.

10.9 Keep the landing doors or gates closed when the car is away from floor level, except while working at a particular entrance.

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10.10 Take full safety precautions while riding the car top and using the “car top control unit”. These precautions must be followed:

a. ensure that there is a firm place on which to stand which is well lit and free from oil and grease;

b. keep a firm hand-hold on the crosshead or other parts of the car when it is moving. Avoid using moving suspension ropes as a hand-hold as they can be dangerous;

c. restrict travel to the **down** direction whenever possible;

d. test the emergency stop switch on the car top control before commencing any work;

e. be aware of all obstructions and moving parts within the lift well (that is, guide brackets and counterweight);

f. after the car has moved, ensure that the emergency stop button is in the **off** position (see procedure for operation of car top control unit).

10.11 Do not use naked flame in the lift well.

10.12 Do not leave tools or components lying around the floor as they could create a hazard.

10.13 Take care to avoid leaving patches of grease or oil throughout the building.

10.14 Observe all rules of safe conduct for the building or area and comply with the client’s safety rules.

10.15 Ensure that the fire alarm and fire drill procedures are known and understood.

10.16 Avoid wearing loose or unbuttoned clothing which may become entangled with moving machinery.

General appraisal

10.17 The first duty of a service person on a routine visit is to make a general appraisal of the condition of the lift. This involves:

a. making a full ascent and descent to assess the quality of the ride at all points;

b. making a second full journey, stopping at every floor to check operation of car and landing doors and/or gates and also floor levelling;

c. in the case of an automatic lift making a call from each floor, at intermediate floors, the car should be called when it is both above and below the floor in question. Check operation of indicator system at each floor.

10.18 During routine visits, both the general condition of the installation and the particular condition of units and components should be assessed.

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NOTE: Assessing possible failures and taking preventative steps may also be carried out at this stage.

10.19 Repair and/or replacement needs may be identified. If so, they should be reported and the client's instructions obtained before the work is started. Such work may not be urgent, for example where the strands of a suspension rope are noticeably worn, replacement within a given period of time may be recommended.

Use of car top control unit

10.20 This unit is incorporated for the use and safety of qualified service engineers whilst inspecting/repairing the lift installation.

10.21 The unit normally incorporates the following functions:

a. light fitting;
b. standard 3-pin plug, fused at 5 amp;
c. test/normal switch;
d. up button;
e. down button;
f. common button;
g. door open/close switch;
h. emergency stop switch (red).

10.22 To gain access to the car top control unit, it is necessary to open a landing door immediately **above** the lift car so that the car top can be reached in a safe manner.

10.23 The landing doors can be opened by using the specified emergency lock release key which is normally kept within the machine room. The emergency stop button should be switched to the **off** position as soon as access is gained to the lift car top.

NOTE: Care should be taken that the landing door(s) remain open until the emergency button is in the **off** position.

10.24 The test/normal switch should then be operated to the **test** position. The landing doors can now be closed.

10.25 To check the correct operation of the emergency stop button, press the **down** button (together with the **common** button – if fitted). The lift should not move.

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10.26 To operate the lift from the car top control unit, the emergency stop button should be placed in the **run** position. Press the **down** or the **up** button (together with the **common** button - if fitted), the lift will move in the respective direction providing that pressure is maintained on the button(s).

10.27 Once the appropriate position in the lift well has been reached, the emergency stop button should be placed in the **off** position.

10.28 When the inspection/repair has been completed, the lift car top should be positioned at a suitable landing entrance so that the lock mechanisms can be reached easily. The emergency stop button should be operated to the **off** position and the landing doors opened.

NOTE: Care should be taken to ensure that the landing door(s) remains open.

10.29 The test/normal switch should then be operated to the normal position and the emergency stop button operated to the **run** position.

NOTE: Leave the car top and ensure that the landing doors are closed correctly.

10.30 Test operation of the lift to ensure normal service.

Inspections in the machine room

Lifting machine

10.31 Check level and condition of the oil in gearbox and note the following:

a. if the worm is beneath the wormwheel, the oil need only cover the worm;

b. if the worm is above the wormwheel, the oil level should be approximately 100 mm above the bottom of the wormwheel;

c. if topping up is required, only the recommended type of oil should be used;

d. gearbox oil should be changed at intervals as recommended by the lift manufacturer.

10.32 Examine the gearbox and oil seals for leaks. Tighten glands as necessary and clean up any surplus oil.

10.33 Run the machine repeatedly in both directions, observing the operation of the motor and check for:

a. excessive movement in the bearings;

b. excessive backlash in the gears.

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NOTE: These may be indicated by over-heating, leakage or abnormal bearing noise.

Drive motor

10.34 The following is recommended:

a. check motor terminals;

b. ensure that the windings are free from dust and foreign matter;

c. check and lubricate bearings, where necessary;

d. ensure that coupling bolts and shaft keys are secure.

NOTE: For detailed guidance on the maintenance of electrical systems refer to SHTM 2007. The manufacturer's literature relating to the installed equipment should be consulted before carrying out any inspections or maintenance work. These notes are indicative of typical requirements.

Brakes

10.35 The brake shoes should be checked for wear and clearance adjusted to comply with the manufacturer's specifications.

10.36 Adjust brake action to give the correct floor levelling and:

a. check that the brake drum is clean, smooth and free of oil and grease;

b. check that the brake operation complies with manufacturer's specification and adjust as necessary;

c. check brake linings for wear, and lubricate all pins as required (examine condition of lining surface and check for proud rivets);

d. check that brake fixing bolts and electrical connections are secure and the settings of brake contacts complies with manufacturer's specifications;

e. at the specified maintenance interval, remove the solenoid brake plunger, check for wear, and clean and lubricate to comply with manufacturer's specification.

Traction

10.37 With the lift car empty and at one limit of travel, mark a chalk line across the suspension ropes and sheaves, Move the lift car to the other limit and back again and check the marks. If the indication is that no suspension rope has slipped by more than 10 mm, the traction may be considered satisfactory.

10.38 If all suspension ropes have slipped by the same amount, the rope tension equaliser may be considered effective.

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NOTE: The amount of wear which has taken place on the grooves should be checked.

Wear of grooves

10.39 Visually check the condition of grooves to ensure that ropes are correctly seated.

NOTE: Normally ropes do not run in the bottom of the grooves. This would cause loss of grip (traction) and slipping ropes would polish the bottom of the grooves.

Vee sheave

10.40 Examine the vee sheave and shaft for cracks or damage and check on the security of the key.

Fixing bolts

10.41 Make a general check that fixing bolts are tight and properly locked.

NOTE: Particular attention should be paid to the bolts holding the winding machine to the bed plate and the bed plate to the floor.

Inspection of controller

10.42 A thorough examination of the various controller components should be carried out.

Switches

10.43 The following is recommended:

a. check contacts for signs of wear and pitting;
b. check mechanical action and ensure that faces make maximum contact;
c. clean, adjust or replace in accordance with manufacturer's specifications;
d. check security of electrical terminations.

Overheating and deterioration of terminations and insulation

10.44 The wiring and components should be checked for signs of overheating, such as:

a. deformation of components;
b. discoloration;
c. charring of cables;

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d. flaking or blistered paint;

e. acrid smell.

10.45 All terminations should be checked for deterioration due to loose nuts or screws which can cause local hotspots and oxidisation.

10.46 The wiring insulation resistance should be checked and results tabulated for reference purposes.

NOTE: For details of measuring insulation resistance of wiring circuits refer to SHTM 2007.

Fuses

10.47 Fuses should be maintained as follows:

a. switch off and isolate electrical supply;

b. remove fuse carrier;

c. check rating;

NOTE: Neither the re-wireable nor the cartridge type fuse should show signs of overheating in any part of the base or the holder.

d. examine for signs of overheating or oxidisation;

e. clean carrier and fuse;

f. if necessary, replace with wire or cartridge of correct rating;

g. replace fuse carrier.

Thermal overloads

10.48 A guidance procedure to test the operation of these devices is as follows:

NOTE: These devices are used to protect certain ancillary motors (for example door operators).

a. set thermal overload at minimum current;

b. stall the motor and check that the overload trips within specified time;

c. check that tripping does not occur when the lift is moved between two floors all the way at low speed.

Resistors and capacitors

10.49 These components should be checked visually for physical damage and any signs of overheating.

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Transformers

10.50 Transformers should be checked for physical damage and signs of overheating.

10.51 Any ducts passing vertically through the windings and any spaces between the windings and the core should be checked for clogging.

NOTE: As and when necessary a power blower can be used to clear the ducts and spaces.

Rectifiers

10.52 Rectifiers should be checked for physical damage and signs of overheating.

10.53 The voltage should be checked for compliance with manufacturer's specifications.

NOTE: As and when necessary, a power blower can be used to clear spaces between cooling fins.

Overspeed governor and switch

NOTE: It is recommended that the overspeed governor and switch are inspected on a monthly basis.

10.54 A guidance procedure to test the operation of this device is as follows:

a. switch off and isolate the electrical supply;
b. check operating mechanism for free movement;
c. check condition of the safety rope and lubricate sheave bearings;
d. check that the switch is free to operate before the jaws grip the governor rope;
e. clean and lubricate moving parts as necessary;
f. check the switch and service the contacts if required;
g. reset electrical and mechanical trips ready for normal operation;
h. ensure that the safety cover is replaced.

Diverting pulleys

NOTE: These pulleys are used to divert ropes (for example from sheave over diverting pulley to counterweight), they are simple "idlers".

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10.55 A guidance procedure to test the operation of these pulleys is as follows:

a. check pulley is secure on shaft;
b. examine pulley for cracks and damage;
c. check fixing bolts, tighten if necessary;
d. lubricate bearings, if necessary.

Lift well equipment

Terminal switches

NOTE: These switches stop the lift car at the top and bottom positions of its travel.

10.56 Guidance to service these switches is as follows:

a. isolate electrical supply;
b. check security of the switch box mounting;
c. remove the cover;
d. inspect the switch for:
   (i) mechanical wear;
   (ii) condition of contacts and terminations;
e. inspect the roller;
f. lubricate the roller bearing and arm pivot;
g. clean and adjust contacts as necessary;
h. clean interior of the box,
i. replace the cover.

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Limit switches

NOTE: The limit switches are two final switches (at the top and bottom) to control lift over-travel conditions.

10.57 Guidance for inspection and service is similar to that for terminal switches.

Proximity switches (inductor type)

10.58 This type of switch is used to initiate various functions such as slowing down, levelling or stopping the lift car. They can also operate door zone and opening gear. Check alignment and security of vanes.

NOTE: The inductor switches are normally fitted on top of the lift car and are operated by steel vanes within the lift shaft.

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Tape heads

10.59 The tape head is normally fitted to the top of the lift car and is operated by magnets attached to a steel tape running the full height of the lift shaft. The following are recommended:

a. check security of tape head and carry out a visual inspection;

b. check tape head guides for wear.

Rope chains and tapes

10.60 A visual examination for rope wear is recommended for all suspension ropes along the full length which passes over the sheave in a complete journey of the car. Check for:

a. broken strands;

b. deformation of rope;

c. corrosion;

d. security of anchorage.

NOTE: The life of a suspension rope is dependent on many factors after it has been correctly installed. It can be stated generally, that the single greatest factor affecting the rope life is the number of pulley bends made by the rope and also the radius of such bending. It will be appreciated that no definite guide can be given as to the life of a suspension rope, but particular care should be exercised where the ropes are more than ten years old.

Compensating, tensioning ropes of chains, rope anchorages/ terminations and tensioning

10.61 The following are recommended:

a. check anchorages/terminations;

b. check for wear, deformation and corrosion;

NOTE: Rope terminations or anchorages should be fitted in accordance with each manufacturer's instructions. At every thorough inspection they should be closely examined for signs of deterioration and/or wear. The fitment of detachable terminations such as wedge sockets and grips should be checked for security and it should be noted that broken wires can develop at these terminations or anchorages.

c. if tension equalisers are not fitted, suspension ropes should be checked to ensure that the load is being properly distributed;

NOTE: A method of checking rope tension is to pull horizontally on each rope for a fixed distance with a spring balance. If tensions are equal, similar spring balance readings will be obtained for each rope deflection.

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d. adjust at screwed anchorage as necessary;

e. where tension equalisers are fitted, they should be inspected and the pivots lubricated;

f. ensure that the equalising mechanisms is not at the limit of the movement;

NOTE: Ropes are lubricated internally during manufacture and this is usually sufficient to prevent corrosion. The presence of the correct degree of lubrication can best be judged by a slightly oily deposit on the traction sheave grooves. If the machine is operating in a contaminated or hot environment, the original lubrication may prove inadequate, and it may be necessary to very lightly dress the rope with a non-acid lubricant to inhibit corrosion or to offset drainage. Excessive lubrication should be avoided, as this may encourage slip between the ropes and the traction sheave.

Guides and guide shoes

NOTE: This is best done from the top of the car.

10.62 The following checks are recommended:

a. check the condition of the car and counterweight guides;

b. check the security of the fishplates and clips at all joints;

c. inspect upper guide shoes (from the top of car) and lower guide shoes (from the lift pit) and check for:

(i) security of fixings;

(ii) amount of side play;

(iii) action of springs (where fitted);

(iv) condition of linings (where fitted).

NOTE: Most guide shoes have a renewable liner (gib). To renew a liner, the guide shoe should be removed from the lift car or counterweight. When refitting the shoe, care should be taken to restore the original alignment of the lift car or the counterweight to guides.

d. if lubricators are fitted on top of the car, the reservoir should be topped up with the correct grade of lubricant.

NOTE: On certain installations a dry guide is fitted. In such circumstances, a PTFE compound is brushed on at suitable (long) intervals.

Car/counterweight buffers

10.63 Check that all fixings are square and secure.

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10.64 For spring buffers, the following checks are recommended:

a. springs are not distorted;

b. coils are free from obstructions;

c. if the buffer is of the spring return type depress as far as possible and check that the buffer returns the spring to its normal position.

10.65 For oil buffers, the oil level should be checked and topped up if necessary.

10.66 Check operation of the switch.

Governor tension frames and pulleys

10.67 The following checks are recommended:

a. the tension frame is not touching the lift pit floor;

b. all bearings and pivot points on the tension frame, oil as required;

c. check rope stretch;

d. check that the slack rope switch functions correctly and ensure that the weights move freely;

e. check security of attachment of the governor rope to the safety gear on the lift car.

Travelling cables

10.68 Position car above lowest landing served to allow access to bottom of car from pit.

10.69 Render car inoperative by operating the emergency pit switch to the **off** position.

10.70 Ensure the landing doors remain in the open position and that the entrance is adequately protected.

10.71 From the pit, carry out an inspection of the under-car anchor point to ensure that the cable is secure and that there is no sign of deterioration or chafing of cable.

10.72 From the top of the car, inspect the lift well anchor point and remainder of cable.

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Landing door locks

10.73 It is recommended that the fitting at every landing is tested to ensure that doors are mechanically locked and the following should be carried out:

NOTE: It is recommended that the landing and car door locks are inspected on a monthly basis.

a. check security of fixings;
b. check correct operation in relation to door travel in accordance with manufacturer's specifications;
c. check contacts and electrical terminations;
d. lubricate moving parts and service contacts if necessary;
e. check operation of emergency door release where fitted.

Car door interlock

10.74 The following checks are recommended:

a. check security of fixings;
b. check correct operation in relation to door travel in accordance with manufacturer's specifications;
c. check contacts and electrical terminations;
d. moving parts and contacts lubricate/service if necessary.

Inspection of the lift car

10.75 Ensure that the top of the lift car is clean and clear of any debris.

10.76 Check the condition of all ropes, and examine for signs of wear or deterioration.

10.77 Check rope anchorages on both the lift car and counterweight for movement and alignment.

10.78 Check the condition of the multiplying pulleys and bearings. Lubricate if necessary.

10.79 Check the security of the governor rope anchorage and the tensioning of the governor rope and safety line.

10.80 Ensure that all components are clean and free from rust.

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Inspection of safety gear

NOTE: If the safety gear has been fully tested and certified before handover, then a fully loaded speed test is only required after a major overhaul involving a change of rated load or rated speed, or the disturbance of the car sling and/or safety gear assembly. In the absence of a type test certification, a fully loaded lift car test should have been demonstrated by the manufacturer at the commissioning stage.

10.81 For **progressive (wedge clamp) safety gear**, the following is recommended:

a. position the car so that the safety gear can be examined from the pit;

b. render the car inoperative by operating the “emergency pit switch” to the off position;

c. check that in their normal position, the safety shoes are clear of the guides;

d. check the link rods and ensure that all moving parts are well lubricated;

e. reset safety gear for normal operation.

NOTE: If other types of safety gear are fitted, they should be serviced in a similar manner. In some installations, safety gear is also fitted to the counterweight. Similar equipment is used as for the car and it should be serviced in the same way.

10.82 For **instantaneous safety gear**, the following is recommended:

a. position the car so that the safety gear can be examined from the pit;

b. render the car inoperative by operating the emergency pit switch to the **off** position;

c. Inspect the safety gear, which is on the underside of the car, and ensure that there is adequate clearance between the roller and guide;

d. check operating levers and ensure that moving parts are well lubricated.

NOTE: It is recommended that all types of safety gear be inspected on a monthly basis.

Door operators

10.83 The following checks are recommended:

a. take the car to each floor and check the full door operation;

b. check that the landing doors will cease closing when obstructed;

c. check the security of all door operator components and the alignment of the door coupler or skate;

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NOTE: Where photo-electric or other passenger proximity protection is fitted, check that the car doors open when the light beam is interrupted or when the entrance is obstructed.

d. lubricate all moving parts as required by the manufacturer's specifications and service electrical contacts, if necessary;

e. check condition of door gear motor and drive.

Mechanical door protection device (safety edge)

10.84 The following checks are recommended:

a. all cables and pivots are free;

b. when the safety edge is operated, the door reopens;

c. after operation and removal of obstruction, the safety edge re-sets and the door closes normally.

Lift car operating panel

10.85 The following checks are recommended:

a. check that all position indicators work correctly;

b. where a communication system is fitted, check that it functions correctly;

c. ensure that the alarm is clearly audible when the alarm button is depressed;

d. check the operation of the car push buttons (floor buttons). If these are of the illuminated type, replace any faulty lamps ensuring that the replacements are of the correct voltage and watt rating;

e. check that the lift doors open when the "door open" button is depressed.

Emergency arrangements

10.86 Check that the car emergency flaps or access panels can be opened or removed. Ensure that associated electrical interlocks prevent the car from being moved.

10.87 If emergency lighting is fitted, check that it operates when the normal supply is switched off.

Light fittings

10.88 Check that all lamps are in working order.

10.89 Clean the diffuser with a clean, damp cloth.

10.90 Check the security of the diffuser frame.

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Landing entrances

General

10.91 Check that the floor in the immediate vicinity of the landing door is in a clean and safe condition.

10.92 Check doors, gates and architraves for mechanical damage. Ensure that there is nothing which can catch a passenger's clothing and that the clearance between the doors or gates and the architraves is to manufacturer's specification.

10.93 Clean the top and bottom tracks. Lubricate as necessary.

10.94 Check the setting of the eccentric retaining rollers, where fitted, on the top of door hangers.

10.95 Check the adjustment of the linkage between associated door panels.

10.96 Check the security of the door bottom shoe fixing.

10.97 Check that the apron attached to car sill is in good condition and firmly fixed.

Push buttons

10.98 Check the correct operation of all push buttons.

10.99 Remove covers and clean interior of boxes.

10.100 Replace any faulty lamps found in illuminated push buttons with lamps of correct voltage and watt rating.

Position indicators

10.101 Check that all indicators are working properly.

10.102 Remove covers and clean interior of boxes.

10.103 Replace faulty lamps with ones of correct voltage and watt rating.

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11. Care of decorative finishes

Stainless steel

General

11.1 Stainless steel is used for various items of decor on lift installations because of its strength, durability and lasting appearance. Despite the general ease of maintenance, however, some simple precautions should be taken to preserve its appearance over the years.

11.2 The actual environment in which it is used will determine how frequently attention is required. It is important to ensure that the visible surfaces are open to the oxygen in the air. This can only be achieved if the stainless steel is kept clean and free from grime and other deposits.

Plain stainless steel

11.3 All cleaning should be carried out in the direction of the original polish lines using a soft clean cloth.

Patterned stainless steel

11.4 It may be necessary to use a soft brush to ensure that dirt is removed from the low areas of embossed stainless steel.

Normal cleaning

11.5 Wash regularly with warm water and mild soap or mild liquid detergent, rinse thoroughly and wipe dry.

11.6 Resistance to finger marking can be improved and a more even sheen obtained if the complete stainless area is wiped over with a soft cloth moistened with a few drops of an approved polishing oil. Allow to dry and buff with a clean cloth to the point that only a bright, wax-like coating remains

Heavier grime and grease

11.7 If normal cleaning fails to remove some deposits, then it may be necessary to apply a stronger cleaning powder on a damp cloth to remove them by gently rubbing in the direction of the original polish lines.

11.8 Heavy deposits of oil or grease can be removed with a soft cloth dampened with white spirit. Wash down afterwards as for normal cleaning and oil if necessary.

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11.9 To summarise, it is recommended to:

a. wash regularly;
b. remove grime and grease;
c. always clean in direction of polishing lines;
d. rinse after cleaning and wipe dry.

and not to:

e. use steel wool or metal scrapers;
f. allow dirt to accumulate;
g. use harsh untested cleaners.

NOTE: Damaged stainless steel can often be restored by expert metal finishers, their advice should be sought if necessary.

Cellulose and laminate finishes

11.10 These finishes are used for various items of decor. To assist in maintaining their appearances they should be washed regularly with warm water and mild soap or mild liquid detergent, rinsed thoroughly and dried off. Wipe over with a soft cloth and polish with an approved polish. White spirit may be used to remove grime, etc. if necessary.

Aluminium finishes

Fluted aluminium

11.11 Wash regularly with warm water and mild soap or liquid detergent, rinse thoroughly and dry off. Wipe over with a soft cloth moistened with a few drops of an approved polishing oil. Allow to dry and buff with a clean cloth until only a bright, thin, wax-like coating remains.

Plain aluminium satin finish

11.12 As this finish is already treated with a permanent protective transparent lacquer, a regular wipe with a damp soft cloth and a final light rub over with a dry soft cloth is all that should be necessary.

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Real bronze finishes

11.13 Real bronze is used for various constructional and decorative trims and carries a natural satin or toned satin finish. As the surface of bronze work is protected by a permanent protective transparent lacquer, a regular wipe with a damp soft cloth followed by a final light rub with a dry soft cloth is all that should be necessary.

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12. Designated staff functions

12.1 Only trained authorised and competent persons (lifts) should be appointed by management to control the operation and maintenance of lifts.

12.2 **Management**: the owner, occupier, employer, general manager, chief executive or other person who is accountable for the premises and is responsible for issuing or implementing a general policy statement under the Health and Safety at Work etc (HSW) Act 1974.

12.3 **Designated person (electrical)**: an individual who has overall authority and responsibility for the premises containing the electrical supply and distribution system within the premises and has a duty under the HSW Act 1974 to prepare and issue a general policy statement on health and safety at work, including the organisation and arrangements for carrying out that policy. This person should not be the authorising engineer.

12.4 **Designated person (lifts)**: an individual who has been nominated by management to ensure that lift operations are kept to a satisfactory standard including mandatory examinations, record keeping and emergency procedures.

12.5 **Duty holder**: a person on whom the Electricity at Work Regulations 1989 impose a duty in connection with safety.

12.6 **Competent person (lifts)**: a person with adequate training, both theoretical and practical, and with experience of the equipment (lift installation) under examination to enable a true assessment of its continued safe operation to be made and who is supported within an appropriate organisation.

NOTE: This definition of competent person (lifts) is synonymous with the definition of authorised person as defined in BS 7255: 2001.

12.7 **Employer**: any person or body who:

a. employs one or more individuals under a contract of employment or apprenticeship;

b. provides training under the schemes to which the Health and Safety (Training for Employment) Regulations 1990 (SI 1380:1990) apply.

12.8 **Authorising engineer (high voltage)**: a chartered electrical engineer with appropriate experience and possessing the necessary degree of independence from local management who is appointed in writing by management to implement, (as appropriate) administer and monitor the safety arrangements for the high voltage electrical supply and distribution systems of that organisation to ensure compliance with the Electricity at Work Regulations 1989 and to assess the suitability and appointment of

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candidates in writing to be authorised persons (see SHTM 2021; *Electrical safety code for high voltage systems*).

12.9 **Authorising engineer (low voltage)**: a chartered engineer or incorporated electrical engineer with appropriate experience and possessing the necessary degree of independence from local management who is appointed in writing by management to advise on and monitor the safety arrangements for the low voltage electrical supply and distribution systems of that organisation to ensure compliance with the Electricity at Work Regulations 1989 and to assess the suitability and appointment of candidates in writing to be authorised persons (see SHTM 2020; *Electrical safety code for low voltage systems*).

12.10 **Authorised person (electrical)**: an individual possessing adequate technical knowledge and having received appropriate training, appointed in writing by the authorising engineer to be responsible for the practical implementation and operation of management's safety policy and procedures on defined electrical systems (see SHTM 2021 and SHTM 2020).

12.11 **Competent person (electrical)**: an individual who, in the opinion of an authorised person, has sufficient technical knowledge and experience to prevent danger while carrying out work on defined electrical systems (see SHTM 2021 and SHTM 2020).

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13. Definitions

13.1 **Department**: an abbreviation of the generic term “UK Health Departments”: Scottish Executive Health Department.

13.2 **Lift**: an appliance for transporting persons or goods between two or more levels by means of a guided car moving in a substantially vertical direction and travelling in the same path in both upward and downward directions (BS).

13.3 **Traction lift**: a lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine (BS).

13.4 **Hydraulic lift**: a lift in which the lifting power is derived from an electrically-driven pump transmitting hydraulic fluid to a jack acting directly or indirectly on the car (BS).

13.5 **System**: a system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy, including such source and such equipment.

13.6 **Injury**: death or personal injury from electrical or mechanical failures.

13.7 **Danger**: a risk of injury.

13.8 **Essential circuits**: circuits forming part of the essential services electrical supply so arranged that they can be supplied separately from the remainder of the electrical installation.

13.9 **Emergency supply**: any form of electrical supply which is intended to be available in the event of a failure in the normal supply.

13.10 **Essential service electrical supply**: the supply from an engine-driven a.c. emergency generator which is arranged to come into operation in the event of a failure of the normal supply and provide sufficient electrical energy to ensure that all basic functions of the healthcare premises are maintained in service.

13.11 **Electrical equipment**: includes anything used, intended to be used or installed for use to generate, provide, transmit, transform, conduct, distribute, control, measure or use electrical energy.

13.12 **High voltage (HV)**: the existence of a potential difference (rms value for a.c.) normally exceeding 1000 volts a.c. between circuit conductors or 600 volts between circuit conductors and earth.

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13.13 **Low voltage (LV)**: the existence of a potential difference (rms value for a.c.) not exceeding 1000 volts a.c. or 1500 volts d.c. between circuit conductors or 600 volts a.c. or 900 volts d.c. between circuit conductors and earth.

13.14 **Access doors**: means of access to equipment areas and other spaces pertaining to a lift installation such as machine rooms, overhead machine spaces, etc, and with access usually restricted to authorised persons.

13.15 **Alarm system**: an emergency system installed on all lifts, which comprises a bell, a push button installed in the car and an uninterruptible source of power (usually a battery).

13.16 **Algorithm**: a set of rules to which a system (often a control system) must conform.

13.17 **Annunciator**: a signalling device which provides passengers with information regarding lift car position, etc, by means of indicator lamps or audible announcements.

13.18 **Armature**: the rotor or moving part of a direct current (d.c.) machine.

13.19 **Automatic control**: a generic term used to define any error-activated, power-amplifying, negative feedback, closed loop, control system.

13.20 **Brake**: an electromechanical device consisting of a spring assembly, which is held in compression by the energising of an electromagnet, and which holds the friction shoes from the contact with the brake drum or disc, thus allowing the lift car to move. In the event of the car exceeding its rated speed, or a power failure, or a control system demand to hold the car stationary, the brake is de-energised and the brake operated, thus stopping the car in a safe distance or holding the car in position.

13.21 **Buffer**: device capable of absorbing the kinetic energy of motion of a descending car or counterweight, when they have passed a normal limit of travel, by providing a resilient stop, and comprising a means of braking using fluids or springs (or similar means).

13.22 **Buffer (car)**: a final emergency device to bring a lift car to rest by absorbing the energy of motion should the car pass the normal downward limit of travel.

13.23 **Buffer (counterweight)**: a final emergency device to bring a counterweight to rest by absorbing the energy of motion should the counterweight pass the normal downward limit of travel.

13.24 **Buffer (stroke)**: the distance that a buffer can be compressed.

13.25 **Call**: a demand for service by a passenger which is entered into a lift supervisory control system by the passenger pressing either a landing or car call push button.

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13.26 **Call back**: a service visit, at the request of a lift operator, made by a lift maintenance technician, which is not scheduled and which arises because the lift has gone out of service owing to a fault condition.

13.27 **Call push button**: a push button situated either in a car or on a landing by which passengers may indicate their travelling intention.

13.28 **Car**: the load-carrying unit comprising enclosure, car frame, platform and door(s).

13.29 **Circulation**: the process by which persons in a building move around the building in both horizontal and vertical modes.

13.30 **Counterweight**: a component which is employed to ensure traction between the drive sheave and the suspension ropes and which comprises a set of weights to balance the weight of the car and a proportion of the load in the car, often taken as 50% of the contract load.

13.31 **Counterweight (car)**: a counterweight which is directly roped to the lift car on a winding drum installation and which is approximately 70% of the car weight.

13.32 **Counterweight (guard)**: a screen installed in the pit to prevent persons from encroaching into the counterweight runway space.

13.33 **Counterweight (guides)**: steel T-shaped sections which guide the counterweight in its vertical travel.

13.34 **Counterweight (safety)**: a mechanical device attached to the counterweight frame designed to stop and hold the counterweight in the event of an overspeed or free fall or the slackening of the suspension ropes.

13.35 **Contract speed**: the rated speed of the lift that has been specified by the designer and agreed with the manufacturer.

13.36 **Control (directional collective)**: where landing calls are registered on a set of up and down landing call push buttons, the landing and car calls being registered in any order but answered strictly in floor sequence in the direction of travel, taking account of the direction of travel of the registered landing calls.

13.37 **Control (group collective)**: a simple form of group control system, where two (duplex) or three (triplex) cars are interconnected and collectively controlled, but providing a means of allocation of the best placed car to each landing call.

13.38 **Control (non-collective)**: the simplest form of control whereby a car will only answer a landing call if it is available.

13.39 **Cylinder**: the outermost lining of a hydraulic jack.

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13.40 **Device (levelling)**: a mechanism which will move a lift car, when it is in the levelling zone, at a reduced speed towards a landing and stop it there.

13.41 **Device (signalling)**: an annunciator (light, indicator, bell, buzzer, etc,) which provides information to passengers about car direction, car position, car arrival, call acceptance, etc.

13.42 **Diversity factor**: a factor which may be applied to reduce the sizing of services, for example electric power cables, on the basis of a mathematical probability that not all connected equipment will require serving at the same time.

13.43 **Door**: the portions of the car or landing entrance which control the safe access to and from the moving car.

13.44 **Drive (direct)**: a drive where the driving part is directly connected to the driven part, either with or without intermediate gears.

13.45 **Drive (indirect)**: a drive system where the driving part is connected to the driven part by means of V-belts, tooth drive belts, or drive chains.

13.46 **Drive (drum)**: a positive drive system whereby the car and the counterweight are secured to a multi-grooved drum so that as one set of ropes unwinds from the drum, the other set winds on.

13.47 **Drive-unit**: a power unit which provides the means for raising and lowering the car and which comprises: an electric motor or hydraulic power unit; gearing; brake; sheave or drum; couplings and bedplate.

13.48 **Entrance (car)**: the protective assembly which closes openings normally used for entrance to and exit from the car the lift enclosure.

13.49 **Error**: an event which is not fatal to the operation of a lift system, but which could result in degradation, malfunction, interruption or failure and which should be corrected as soon as possible.

13.50 **Failure**: an event which results in a lift system becoming unserviceable.

13.51 **Floor (car)**: the under-surface of the interior of a lift car on which passengers stand.

13.52 **Floor (main)**: the main or principal floor of a building.

13.53 **Floor (parking)**: a floor at which a lift car is parked when it has completed serving its car calls and the supervisory control system does not reallocate it to serve further landing calls.

13.54 **Front**: the front (of a lift car) is the side in which the entrance is situated or in the case of multiple entrances, the side containing the entrance nearest to the car operating panel.

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13.55 **Gear**: wheels working one upon another, by means of teeth (or otherwise), for transmitting or changing motion and power.

13.56 **Gear (helical)**: gear wheels twisted obliquely to the gear wheel running on parallel axes with the teeth axles.

13.57 **Gear (worm)**: a gear used to connect non-parallel, non-intersecting shafts with the teeth of the intersecting wheels cut on an angle.

13.58 **Governor**: strictly a mechanical device which is a closed loop, error-activated means of automatically controlling the speed of a machine, but in the lift context it is used to detect an overspeed situation.

13.59 **Governor (centrifugal)**: a mechanical device which utilises the effects of centrifugal forces operating on weights rotating in a horizontal or vertical plane to provide a movement which can in turn be used to operate a control device.

13.60 **Governor (overspeed)**: a governor used to detect the occurrence of a predetermined speed.

13.61 **Groove (U-profile)**: a groove cut into a drive sheave, which is semi-circular in shape, and of a radius which is approximately equal to the diameter of the suspension rope.

13.62 **Groove (undercut)**: a groove cut into a drive sheave, which is a modified V-groove having the lower sides cut in the shape of a “U”.

13.63 **Groove (V-profile)**: a groove cut into a drive sheave in the shape of a “V”.

13.64 **Group**: a group of cars: a number of cars placed physically together, using a common signalling system, and under the control of a supervisory control system.

13.65 **Guide rail**: a set of vertical, machined surfaces installed in the lift to guide the travel of a lift car or counterweight.

13.66 **Guide shoes**: devices used to guide the movement of doors, cars and counterweights along their associated guide rails.

13.67 **Hand-winding**: the action of using a manual lowering device to permit the emergency lowering/raising of a lift.

13.68 **Harmonic currents**: alternating currents at multiples of the mains frequency which flow when a non-linear load is connected to the supply.

13.69 **Hydraulic power unit**: part of the lift drive system and comprising pump, pump motor, control valves and fluid storage tank.

13.70 **Indicator (car position)**: an indicator adjacent to, or above, a car or landing entrance, which is illuminated to indicate the position of the lift car in the well.

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13.71 **Indicator (landing direction)**: an indicator adjacent to, or above, a car entrance, which is illuminated whenever that car is to stop at that landing and which indicates the intended direction of travel for the car.

13.72 **Indicator (lift in use)**: an indicator adjacent to, or contained within, a landing call push button, which is illuminated whenever the lift is busy serving a demand, usually fitted on installations controlled by a very simple supervisory control system.

13.73 **Interference (electrical)**: unwanted signals transmitted via the electrical supplies or as electromagnetic radiation, which can interact with properly generated signal sequences to produce incorrect or hazardous operation of equipment.

13.74 **Interval**: the average time between successive car arrivals at the main terminal (or other defined) floor with no specified level of car loading or traffic condition.

13.75 **Jack**: the piston (plunger) and cylinder of a hydraulic lift.

13.76 **Jaws**: parts of overspeed safety gear which grip the governor rope (in the case of an overspeed governor) and grip the machined surfaces of the guide rails (in the case of car or counterweight safeties).

13.77 **Jerk**: the rate of change of acceleration with time.

13.78 **Landing**: a portion of floor or corridor adjacent to lift car entrances, where passengers may enter or leave.

13.79 **Lay**: the twisting of yarn (wires) to form a strand or the twisting of strands to form a rope.

13.80 **Lay (Langs)**: the direction of the lay of the wires in the strand is the same as the direction of the lay of the strands in the rope.

13.81 **Lay (left)**: the strands of a rope are spun in a anticlockwise direction.

13.82 **Lay (ordinary)**: the direction of the lay of the wires in the strand is opposite to the direction of the lay of the strands in the rope.

13.83 **Lay (right)**: the strands of a rope are spun in a clockwise direction.

13.84 **Levelling**: an operation which improves the accuracy of stopping at a landing and which ensures that the car platform is level with the floor.

13.85 **Lift (bed/passenger)**: lifts for the conveyance of patients being moved on beds or trolleys in hospitals, clinics, nursing homes, etc.

13.86 **Lift (electric)**: a power lift which uses an electrical drive machine to provide energy for the movement of the car.

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13.87 **Lift (fireman's)**: a lift which may or may not be supplied with additional fire-resistant protection, designated to have controls that enable it to be used under the direct control of the fire-fighting services for emergency purposes.

13.88 **Lift (goods)**: a lift primarily used to transport freight and goods, where only the operator and persons necessary to load and unload the freight are permitted to travel.

13.89 **Lift (hydraulic)**: a power lift which uses a liquid under pressure to provide the energy for the movement of the car.

13.90 **Lift (passenger)**: a lift primarily used to carry passengers.

13.91 **Lift (service)**: a lift that is not designed to carry passengers and is generally used for small loads. It is called and despatched externally, normally by a call point adjacent to each level hatch or access door.

13.92 **Lighting (emergency)**: lighting provided in a lift car in the event of a power failure and supplied from a standby generator or emergency batteries.

13.93 **Machine (direct drive)**: an electric driving machine where the motor is directly connected mechanically to the driving sheave, drum or shaft with or without intermediate mechanical gearing.

13.94 **Machine (electric drive)**: a driving machine where the energy is supplied by an electric motor.

13.95 **Machine (geared traction drive)**: a traction drive machine utilising a gear for energy transmission.

13.96 **Machine (gearless traction drive)**: a traction drive machine with no intermediate gearing.

13.97 **Machine (hydraulic drive)**: a driving machine where the energy is supplied by hydraulic fluid applied by means of a moving ram in a cylinder.

13.98 **Machine (indirect drive)**: an electric driving machine, where the motor is connected indirectly by means of belts, chains etc, to the sheave, shaft or gearing.

13.99 **Machine room**: a room or space in which the machine(s) and associated equipment are located.

13.100 **Machine (traction)**: a direct drive machine where the motion of the car is obtained through friction between the suspension ropes and the driving sheave.

13.101 **Motor**: a device which can convert electrical energy into mechanical energy.

13.102 **Noise (acoustic)**: noise which is transmitted through air and which may be generated by parts of a lift installation, such as the machine, car movement,

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ropes and chains in the well, and transmitted via parts of the structure to remote parts of a building.

13.103 **Operator (door)**: a power-operated device which opens and closes the car doors.

13.104 **Panel (vision)**: a small window located in lift doors fitted with safety glass which permits passengers to see when a car has reached a landing.

13.105 **Parking**: action of moving a lift car to a specified floor or leaving it at its current floor, whenever the car has no further calls (landing or car) assigned to it for service.

13.106 **Platform (car)**: load bearing floor of the car enclosure.

13.107 **Push button**: an insulated button which operates electrical contacts when pushed.

13.108 **Pump**: a hydraulic machine which converts mechanical energy into hydraulic energy. In lift practice, the mechanical energy is itself first produced from electrical energy by means of an electric motor, which is coupled directly to the pump.

13.109 **Ram**: the smooth circular moving part of a hydraulic jack which is forced out of the cylinder by fluid pressure.

13.110 **Rope**: a construction of twisted fibres or wire (wire rope) to form a continuous load-bearing element.

13.111 **Rope (compensating)**: wire rope used to counterbalance or partially counterbalance the weight of the suspension ropes as the lift car moves up and down the well.

13.112 **Rope (safety)**: rope attached between the governor rope and the safety gear.

13.113 **Safe-edge**: a mechanically-actuated door re-opening device mounted on the leading edge of a car door which, on colliding with a passenger or other object, causes the car and landing doors to re-open.

13.114 **Safety (car)**: mechanical device attached to the car frame to stop and hold the car should any of three conditions occur: free fall, predetermined overspeed or rope slackening.

13.115 **Safety gear**: a mechanical device for stopping and maintaining stationary on the guides the lift car or counterweight in case of overspeeding in the downwards direction or breaking of the suspension.

13.116 **Safety gear (instantaneous)**: a form of safety gear which applies a rapidly increasing pressure on the guide rails during the stopping period.

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13.117 **Safety gear (progressive)**: a form of safety gear which applies a limited pressure on the guide rails during the stopping period.

13.118 **Sheave**: a wheel having a groove or grooves in its circumference in order to receive a rope or ropes; a pulley.

13.119 **Sheave (guard)**: a protective guard around a rope-carrying sheave.

13.120 **Sheave (drive)**: a wheel, the rim of which is grooved to receive the suspension ropes, and which allows the motion of the driving machine to be transmitted to the ropes by friction.

13.121 **Sling**: a device for lifting bulky or heavy articles.

13.122 **Solid state**: electronic circuits making use of semiconductors.

13.123 **Stroke (oil buffer)**: the distance the buffer piston or plunger moves, excluding the travel of the buffer plunger accelerating device.

13.124 **Stroke (spring buffer)**: the distance the contact end of the spring moves before all the coils are in contact or a fixed stop is reached.

13.125 **Switch (car)**: a switch mounted in the car used to control the motion (starting and stopping) of the car.

13.126 **Switch (final limit)**: an emergency switch used to stop a lift automatically in the event that the car travels a predetermined distance past the terminal landing.

13.127 **Switch (firemans)**: a switch which, when operated, brings the designated car under the control of the fire-fighting service.

13.128 **Traffic analysis**: determination of the statistical characteristics of passenger movements in a lift system.

13.129 **Travel**: the vertical distance a lift can move, measured between the bottom terminal floor and the top terminal floor of a building zone.

13.130 **Ventilation (car)**: means of removal of heat, generated inside the car, by natural or mechanical means, via suitable vents placed in the car enclosure.

13.131 **Viscosity**: the specific resistance of a fluid to flow.

13.132 **Well**: the space bounded by the bottom of the pit, the walls and the roof in which the car and counterweight travel.

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NOTE:
Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

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